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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is included. (AG)

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ED 059298

TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

ELECTRIC MOTOR ASSEMBLER 6-99.166

S-21 (Formerly B-230)

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
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U. S. Employment Service in
Cooperation with
Arkansas State Employment Service

U. S. DEPARTMENT OF LABOR
Bureau of Employment Security
Washington 25, D. C.
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GATB #614
March 1951

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY FOR ELECTRIC MOTOR ASSEMBLER (elec. equip.) 6-99.166

S-21

Summary

The GATB was administered in December 1950 to 75 women employed in the Electric Motor Assembly Department at Redmond Motors, Inc., Jacksonville, Arkansas. The final sample was reduced to 60 when 15 workers were eliminated from the sample because they had less than six months of experience. Supervisory ratings were used as the criterion. The following aptitudes were found to be significant for this job: Aiming (A), Motor Speed (T), Finger Dexterity (F), and Manual Dexterity (M).

GATB Norms for Electric Motor Assembler 6-99.166 - S-21

Table I shows, for B-1001 and B-1002, the minimum acceptable score for each aptitude included in the test norms for Electric Motor Assembler 6-99.166.

TABLE I

Minimum Acceptable Scores on B-1001 and B-1002 for S-21

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
A	CB-1-C CB-1-K	85	K	Part 8	90
T	CB-1-G CB-1-K	85	F	Part 11 Part 12	80
F	CB-1-O CB-1-P	85	M	Part 9 Part 10	80
M	CB-1-M CB-1-N	85			

Effectiveness of Norms

The data in Table IV indicate that 7 of the 9 poor workers, or 77 percent of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. This shows that 77 percent of the poor workers would not have been hired if the recommended test norms had been used in the selection process. Moreover, 38 of the 40 workers who made qualifying test scores, or 95 percent, were good workers.

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TECHNICAL REPORT

I. Problem

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupation of Electric Motor Assembler 6-99.166.

II. Sample

The experimental sample consisted of 75 women employed in the electric motor assembly department of Redmond Motors, Inc., Jacksonville, Arkansas. The employees were selected on the basis of an interview. The final sample was reduced to 60 when 15 workers were eliminated from the sample on the basis of experience.

Table II-A shows the means, standard deviations, ranges, Pearson product-moment correlations (corrected for broad categories) with the criterion, and the standard errors of correlation for age, education, and experience for the total sample of 75.

TABLE II-A

Means (M), Standard Deviations (σ), Ranges,
Pearson Product-Moment Correlations (Corrected for Broad Categories)
with the Criterion ($_{c}r$), and the Standard Errors of Correlation ($\sigma_{c}r$)
for Age, Education, and Experience

Electric Motor Assembler 6-99.166
N = 75

	M	σ	Range	$_{c}r$	$\sigma_{c}r$
Age (years)	33.80	9.54	18-54	-.258*	.108
Education (years)	9.36	1.96	5-12	.165	.112
Experience (months)	12.09	6.86	1-22	.335**	.103

**Significant at the .01 level.
*Significant at the .05 level.

The correlation between age and the criterion was significantly negative, indicating that the younger workers were rated higher than the older workers. There were 8 workers over 45 years of age and 4 workers under 20 years of age. Among those under 20 years of age, 3 were in the middle criterion group and one in the high criterion group. The relationship between education and the criterion was not significant. The correlation between the criterion and experience was .335 with a standard error of .103. This indicates that the foreman rated the workers who had been on the job longer higher than the workers with less experience. In view of this, it was desirable to apply a correction to nullify the effects of experience on the criterion. Since the criterion consisted of broad category supervisory ratings and there was not an individual criterion score for each worker in the sample, the statistical formula usually used to nullify the effects of experience on the criterion could not be applied in this instance. An attempt to reduce the influence of experience was made by eliminating from the sample the workers who had less than six months of experience. This eliminated 15 workers from the total sample of 75.

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Table II-B shows the means, standard deviations, ranges, Pearson product-moment correlations (corrected for broad categories) with the criterion, and the standard errors of correlation for age, education, and experience for the sample of 60.

TABLE II-B*

Means (M), Standard Deviations (σ), Ranges,
Pearson Product-Moment Correlations (Corrected for Broad Categories)
with the Criterion ($_{o}r$), and the Standard Errors of Correlation ($\sigma_{o}r$)
for Age, Education, and Experience

Electric Motor Assembler 6-99.166
N = 60

	M	σ	Range	$_{o}r$	$\sigma_{o}r$
Age (years)	34.05	9.92	18-54	-.296	.118
Education (years)	9.27	1.99	5-12	.128	.127
Experience (months)	14.40	5.65	6-22	.248	.121

*This table presents data for the final sample, which includes only those workers who had six or more months of experience.

Exclusion of workers with less than six months of experience from the sample reduced the correlation between the criterion and experience to .248, which is not statistically significant.

III. Job Description

Job Title: Electric Motor Assembler 6-99.166

Job Summary: Assembles small electric motors, less than 1/10 H.P. Places complete motor assembly into case; connects motor lead wires to power source and tests for rpm, torque and volts, using speed gages and thermometers.

Work Performed: Winds, ties, tapes, insulates and loads field coils. Twists wires, cuts and turns insulating paper, spaces channels, inserts metal wedges, and forms coil. Twists and welds coils. Burns lead wires, uses special fixtures to hold parts in position during assembly. Reams, balances, burns, drills, taps, and polishes various parts necessary in the assembly of rotors, including fan assembly and washer assembly. Places complete motor assembly into case using various tools, such as automatic screw driver, pliers, and arbor press. Connects motor lead wires to power source, and tests for rpm, torque and volts, using speed gages and thermometers.

NOTE: The workers perform any combination of the tasks in the job, since they are frequently changed from one task to another.

IV. Experimental Battery

All of the tests in the General Aptitude Test Battery, B-1001, were administered to the sample group.

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V. Criterion

There are three production lines in the plant. The ratings are based on the three foremen's combined knowledge of the abilities of all the workers since no one foreman knew all the workers. The 75 workers were placed in three broad categories - 19 in the high group, 41 in the middle group, and 15 in the low group. When the 15 workers with less than 15 months of experience were eliminated from the sample, the number of workers in each category was as follows: 17 in the high group, 34 in the middle group, and 9 in the low group. For computational purposes, the criterion ratings were converted to quantitative values.

VI. Statistical and Qualitative Analysis

Table III shows the means, standard deviations, Pearson product-moment correlations (corrected for broad categories) with the criterion, and the standard errors of correlation for the aptitudes of the GATB.

The means and standard deviations of the aptitudes are comparable to general population norms with a mean of 100 and a standard deviation of 20.

TABLE III

Means (M), Standard Deviations (σ), Pearson Product-Moment Correlations (Corrected for Broad Categories) with the Criterion ($_{c}r$), and the Standard Errors of Correlation ($\sigma_{c}r$) for the Aptitudes of the GATB

Electric Motor Assembler 6-99.166
N = 60

Aptitudes	M	σ	$_{c}r$	$\sigma_{c}r$
G - Intelligence	89.4	19.0	.177	.125
V - Verbal Aptitude	87.7	18.6	.135	.127
N - Numerical Aptitude	84.2	20.4	.216	.123
S - Spatial Aptitude	94.1	19.6	.128	.127
P - Form Perception	89.3	24.6	.332**	.115
Q - Clerical Perception	80.6	18.1	.251	.121
A - Aiming	98.6	20.1	.401**	.108
T - Motor Speed	96.4	20.1	.361**	.112
F - Finger Dexterity	111.0	22.5	.204	.124
M - Manual Dexterity	111.8	23.5	.335**	.115

**Significant at the .01 level.

The statistical results in Table III were interpreted in the light of the job analysis to determine which aptitudes are significant for the occupation of Electric Motor Assembler 6-99.166. On the basis of job and test data the following aptitudes appear to be important:

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Aiming (A) - to manipulate wires and small parts in the assembly of motors.

Motor Speed (T) - to maintain the speed of the assembly line.

Finger Dexterity (F) - to perform operations which involve handling small objects with the fingers, such as connecting lead wires.

Manual Dexterity (M) - to assemble the motors rapidly and deftly.

From Table III it may be seen that the highest mean scores for this sample were obtained for Aptitudes A, T, F, and M. The lowest standard deviations were obtained for Aptitudes V and Q. Correlations with the criterion, significant at the .01 level, were obtained for Aptitudes P, A, T and M.

Aptitudes A, T, F and M, which appear to be significant on the basis of both statistical and qualitative considerations, were selected for inclusion in the norms. When minimum scores are set at one standard deviation unit below the means of Aptitudes A, T, F, and M, we obtain scores of 79, 76, 89 and 88, respectively. Since these scores are close to those of Occupational Aptitude Pattern 20 (see Part I of Guide to the Use of GATB, B-1001, January 1947), which consists of A - 85, T - 85, F - 85 and M - 85, the selective efficiency of the OAP 20 norms was determined for the sample of sixty Electric Motor Assemblers. It was found that the OAP 20 norms showed good selective efficiency for this sample.

VII. Concurrent Validity of Norms

In order to compute the tetrachoric correlation coefficient between the OAP 20 norms and the criterion of this sample, and to apply the Chi Square test, the criterion was dichotomized. The nine workers rated low by the foremen constitute the low criterion group. Table IV shows the relationship between test norms consisting of Aptitudes A, T, F, and M, each with a minimum score of 85, and the criterion for Electric Motor Assembler 6-99.166. Workers in the high criterion group have been designated as "good workers" and those in the low criterion group as "poor workers."

TABLE IV

Relationship Between Test Norms Consisting of Aptitudes A, T, F, and M, each with a Critical Score of 85, and the Criterion for

Electric Motor Assembler 6-99.166
N = 60

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	13	38	51
Poor Workers	7	2	9
Total	20	40	60

$r_{tet} = .73$ $\quad X^2 = 7.206$

$\sigma_{r_{tet}} = .26$ $\quad P/2 < .005$

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The data in the above table indicate a significant relationship between the test norms and the criterion for this sample.

VIII. Conclusions

On the basis of all the foregoing information, it is recommended that Aptitudes A, T, F, and M, each with a minimum score of 85, be used as B-1001 test norms for Electric Motor Assembler 6-99.166. Equivalent B-1002 norms consist of K - 90, F - 80, and M - 80.